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Attorney Docket No. 2003P08477US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)
Nelson H. Oliver et al.)
Serial No. 10/646,222) Examiner: John Fernando Ramirez
Filing Date: August 22, 2003) Group Art Unit No. 3737
For: Composite Acoustic Absorber for) Conf. No.: 1397
Ultrasound Transducer Backing)
Material and Method of)
Manufacture)

REPLY BRIEF (37 CFR 41.41)

Mail Stop: Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

By the filing of this Reply Brief in accordance with 37 CFR § 41.41, Appellants respectfully request that the appeal be maintained and request reconsideration of the above-identified patent application by the Board of Patent Appeals and Interferences.

The new grounds of rejection do not change the rejection for any of the claims previously argued in the Appeal Brief. To conform with 37 CFR § 41.37(c) as required by 37 CFR § 41.39(b)(2), **the Appeal Brief is repeated herein** with *additions to address the new grounds and replies for the appealed grounds provided in italics.*

Real Party in Interest

The real party in interest is Siemens Medical Solutions USA, Inc., an organization having a place of business in Malvern, Pennsylvania.

Related Appeals and Interferences

There have not been and are no pending appeals, interferences or judicial proceedings which may be related to, directly effect or be directly affected by or have bearing on the Board's decision in this appeal.

Status of Claims

1. Claims 1-2, 4-16, and 18-21 are present and pending in the application.
2. Claims 1 and 4-16 have been finally rejected. Claims 18-21 were allowed, and claim 2 was objected to as being allowed if amended into independent form.
3. The rejection of claims 1 and 4-16 is being appealed. Arguments are submitted below for claims 1, 7, 11, 13, and 16.

Status of Amendments

The amendments to Claims 1 and 4, and the cancellation of claims 3 and 17 were entered by the Examiner as indicated in the Advisory Action dated Feb. 28, 2007.

Summary of Claimed Subject Matter

There are two (2) independent claims involved in this appeal: claims 1 and 13. In addition, there are thirteen (13) dependent claims involved in this appeal: claims 4-12, and 14-16.

A. Independent Claims:

1. Independent claim 1 recites an ultrasound transducer 10 (e.g., paragraph 0017 – page 4, lines 3-6; Figs. 1 and 3) for ultrasound transmission and/or reception (e.g., paragraph 0002-page 1, lines 6-8), the ultrasound transducer 10 comprising at least one transducer element 12 (e.g., paragraph 0018-page 4, lines 6, and 11-17; Figs. 1 and 3), and a backing block 14 (e.g., paragraph 0020-page 4, lines 5 and 24-32, page

5, lines 1-5; Figs. 1 and 3) adjacent the at least one transducer element 12 (e.g., paragraph 0020-page 4, lines 24-25; Figs. 1 and 3), the backing block 14 comprising a composite of first and second materials (e.g., paragraphs 0021-22-page 5, lines 6-11, and 27-31; Figs. 1 and 3), the first material including a plurality of pockets filled with but not bonded to particles comprised of the second material (e.g., paragraph 0021-page 5, lines 12-21; Figs. 1 and 3), wherein the pockets are less than 20 μm along a maximum dimension (e.g., paragraph 0022-page 5, lines 28-31).

2. Independent claim 13 recites an ultrasound transducer 10 (e.g., paragraph 0017 – page 4, lines 3-6; Figs. 1 and 3) for ultrasound transmission and/or reception (e.g., paragraph 0002-page 1, lines 6-8), the ultrasound transducer 10 comprising at least one transducer element 12 (e.g., paragraph 0018-page 4, lines 6, and 11-17; Figs. 1 and 3), and a backing block 14 (e.g., paragraph 0020-page 4, lines 5 and 24-32, page 5, lines 1-5; Figs. 1 and 3) adjacent the at least one transducer element 12 (e.g., paragraph 0020-page 4, lines 24-25; Figs. 1 and 3), the backing block 14 comprising a composite of first and second materials (e.g., paragraphs 0021-22-page 5, lines 6-11, and 27-31; Figs. 1 and 3), the second material incompatible with the first material (e.g., paragraph 0021-page 5, lines 7-12 and 19-21) wherein the second material is operable to generate friction with the first material in response to applied acoustic energy (e.g., paragraphs 0021-page 5, lines 19-23 and 0023-page 6, lines 13-15).

Dependent Claims:

4. Dependent claim 4 recites the transducer of Claim 1 wherein the pockets are less than 13 μm along a maximum dimension (e.g., paragraph 0022).

5. Dependent claim 5 recites the transducer of Claim 1 wherein a density of the first material is within 10 percent of a same density as the second material (e.g., paragraph 0024).

6. Dependent claim 6 recites the transducer of Claim 1 wherein the first material comprises a first fraction of the volume of the backing block and the second

material comprises a second volume fraction of the backing block, the first volume fraction being within 10 percent of a second volume fraction (e.g., paragraph 0024).

7. Dependent claim 7 recites the transducer of Claim 1 wherein the first material has a first acoustic impedance to ultrasound and the second material has a second acoustic impedance to ultrasound, the first acoustic impedance being within 10 percent of the second acoustic impedance (e.g., paragraph 0024).

8. Dependent claim 8 recites the transducer of Claim 1 wherein each of the plurality of pockets comprises a substantially spherical volume (e.g., paragraph 0021).

9. Dependent claim 9 recites the transducer of Claim 1 wherein the first material is incompatible with the second material (e.g., paragraph 0021).

10. Dependent claim 10 recites the transducer of Claim 1 wherein the pockets of the second material are enclosed within the first material, the second material unbound to the first material (e.g., paragraph 0021).

11. Dependent claim 11 recites the transducer of Claim 10 wherein the pockets of the second material are operable to generate friction against the first material in response to applied acoustic energy (e.g., paragraphs 0021 and 0023).

12. Dependent claim 12 recites the transducer of Claim 1 wherein the first material interconnects throughout the backing block, the backing block having a stiffness about the same as the first material (e.g., paragraph 0023).

13. Dependent claim 14 recites the transducer of Claim 13 wherein the backing block includes pockets of the second material within the first material (e.g., paragraph 0021).

14. Dependent claim 15 recites the transducer of Claim 13 wherein the first and second materials comprise different polymers (e.g., paragraphs 0021 and 0025).

15. Dependent claim 16 recites the transducer of Claim 13 wherein the first material has a substantially different hardness but substantially the same acoustic impedance as the second material (e.g., paragraph 0024).

Grounds of Rejection to be Reviewed on Appeal

The grounds of rejection on Appeal are:

1. The rejection of claims 1, 4, and 6-11 pursuant to 35 U.S.C. § 103(a) as being unpatentable over Horner et al. (U.S. Patent No. 4,528,652) in view of Trzaskos (U.S. Patent No. 4,382,201);
2. *The rejection of claim 5 pursuant to 35 U.S.C. § 103(a) as being unpatentable over Horner et al. in view of Trzaskos and further in view of Saito, et al. (US 4,571,520);*
3. *The rejection of claim 12 pursuant to 35 U.S.C. § 103(a) as being unpatentable over Horner et al. in view of Trzaskos and further in view of McElroy, et al. (US 3,794,866); and*
4. The rejection of claims 13-14 and 16 pursuant to 35 U.S.C. §102(b) as being anticipated by Horner et al.

Argument

1. Argument with Respect to Ground of Rejection No. 1

Reversal of the Examiner's rejection of claims 1, 4, and 6-11 pursuant to 35 U.S.C. § 103(a) as being unpatentable over Horner et al. in view of Trzaskos is respectfully requested for the reasons set forth below.

(a) Rejection of Independent Claim 1

Independent claim 1 recites a composite with a first material including a plurality of pockets filed with but not bonded to particles of a second material.

The Examiner relied on Trzaskos for the size limitation (pockets less than 20 µm) of claim 1, and relies on Horner et al. for the composite with a first material including a plurality of pockets filed with but not bonded to particles of a second material.

However, Horner et al. do not disclose these limitations. Horner et al. use a low viscosity potting gel and a filler selected from oxides, metal powders and glass microspheres (abstract and Col. 1, lines 48-52). The potting gel of silicone rubber or epoxy is mixed with the filler (Col. 3, lines 6-14). After mixing, the mixture is degassed in a vacuum chamber (Col. 3, lines 15-18). The mixture is poured over the back of the elements or cast over an element (Col. 2, lines 13-15 and 29-33). The use of silicone or epoxy with the filler does not disclose the materials that are not bonded.

The Examiner alleges unbonded contact by gas evacuation. However, gas evacuation merely removes gases, such as air, introduced by the mixing operation. Gas evacuation is unrelated to bonding between the filler and epoxy or silicone.

The Examiner noted, “since the backing fabrication is stated to be an alternative to adhesive materials and there is no stated indication that the mixture of particles into rubber results in any form of bonding, the disclosure effectively embraces an unbonded particle design.” However, the logic used by the Examiner is not based on the teaching of Horner et al. Horner et al. do not provide for bonded and unbonded embodiments. Instead, Horner et al. mention one embodiment that includes adhesive bonding of a backing block to an array and another embodiment of different backing that does not require the extra adhesive for connection or bonding to the array. By failure to mention bonding, Horner et al. do not indicate a lack of bond to the filler.

Furthermore, the alternative provided by Horner et al. and cited by the Examiner provides for bonded particle design in the composite – the opposite of the allegation by the Examiner. In the old embodiment, Horner et al. note neoprene or gum rubber backing as using added adhesive bonding (col. 1, lines 34-38; and col. 2, line 66-col. 3, line 2). Since these neoprene or gum rubber backings are not self-adhering, adhesive is applied to bond the backing to the elements. However, these materials are solids, limiting the ability to encapsulate wires or other structures (col. 1, lines 34-38; and col. 2, line 66-col. 3, line 2). The alternative solution cited by the Examiner and proposed by Horner et al. is to use self-adhering materials, such as the resin or epoxy gel (col. 1, lines 48-52; and col. 3, lines 3-14). Instead of using added adhesives to bond a solid to an array, these backing materials may be poured onto the elements of the array by casting to provide intimate contact (col. 2, lines 13-15 and 29-33). The casting of self-adhering resin or epoxy avoids the use of extra adhesives. Accordingly, Horner et al. provide resin or epoxy which may bond. Since filler is also added in the casting, the resin or epoxy will bond with the filler material as part of the casting. There is no suggestion to use materials for filler to which the resin or epoxy taught by Horner et al. do not bond.

Horner et al. also provide for solids that need extra adhesives, but these solids are not composites. Horner et al. do not disclose a composite with a first material including a plurality of pockets filled with but not bonded to particles of a second material.

For the reasons above, Horner et al. do not disclose a composite with a first material including a plurality of pockets filled with but not bonded to particles of a second material as required by independent claim 1. Accordingly, reversal of this ground of rejection is respectfully requested.

Reply: Silicone Rubber and Epoxy are Sticky

Claim 1 recites the material filled with but not bonded to particles of a second material. Horner, et al. use silicone rubber or epoxy as the base material or material to which the filler is added. Silicone rubber (e.g., caulk) and epoxy are commonly used bonding agents or glue and known to be sticky. In ultrasound transducer backing usage, silicone rubber and epoxy are used, in part, for their bonding properties. Horner, et al. do not use extra adhesive with silicone rubber or epoxy since both are adhesives themselves. Silicone rubber and epoxy adhere to the filler just as they adhere to the transducer. Silicone rubber and epoxy are sticky like glue, so would bond to the filler particles. Claim 1 is allowable.

Not mentioning an extra adhesive is relied on to show no bonding. However, nothing then holds the backing to the transducer unless the base material is a bonding agent. The reason no extra adhesive is mentioned, supported by the fact that silicone rubber and epoxy are bonding agents, is that the base materials are used for their bonding properties. Extra adhesive is not needed. This adhesive property causes bonds with the filler as well.

(b) Rejection of Claim 7

Claim 7 recites the transducer of Claim 1 wherein the first material has a first acoustic impedance to ultrasound and the second material has a second acoustic impedance to ultrasound, the first acoustic impedance being within 10 percent of the second acoustic impedance. The Examiner relied on the teachings of Horner et al., not Trzaskos, for the limitations of claim 7.

Horner et al. do not specifically disclose the relative impedance. Horner et al. describes a low-viscosity resin heavily filled with a mix of powders. Those powders are chosen to include dense materials, typically metal oxides, and low-density materials like mica to bring the total density of the mix to the desired level. Density provides the

desired acoustic impedance. Horner et al. specifically disclose that heavy oxides, metal powders, and glass microballoons are used as fillers in resin of silicone rubber or epoxy gel (col. 1, lines 48-52 and col. 3, lines 3-18). These materials have different acoustic impedances known to be more than 10% different. To adjust density, materials with different density and corresponding acoustic impedance are taught by Horner et al. For example, silicone rubber and epoxy gels typically have an acoustic impedance less than 4 MRayl and heavy oxides, metal powders and glass have an acoustic impedance greater than 10 MRayl. One epoxy (Eccogel 1265) mentioned by Horner et al. has an acoustic impedance less than 3 MRayl for two formulations and an acoustic impedance of about 12 MRayl for another formulation, but Horner et al. do not mention which formulation. However, all of the mixtures shown in the table (col. 3, lines 25-50) have acoustic impedance no higher than 5.3 MRayl, suggesting the lower acoustic impedance formulation are being taught.

Microballoons are not used as the low-density component in transducer backers, because microballoons scatter as much as they absorb. Scattering is fatal to transducers. The use of microballoons in particular is not enabled for imaging sonography transducers.

Accordingly, reversal of this ground of rejection is respectfully requested.

Reply: Impedance of a Combination does Not show Impedance of the Components

The Examiner cites to the overall acoustic impedance of the composite formed from both the base material and the filler material. The impedances of the combinations of materials shown in the table may be within 10% of each other, but this does not show the acoustic impedance of any of the component materials. As shown in the table at column 3 of Horner, et al., different mix ratios of the same material provide for different acoustic impedance. The acoustic impedances shown in the table are not the impedance of the component materials, but are based, in part, on the mix ratio.

Claim 7 recites that the acoustic impedance of the filler material is within 10% of the acoustic impedance of the backer or base material (e.g. silicone rubber). As noted in the Appeal Brief argument above, different materials have different acoustic

impedance properties. The values given in the argument above are the acoustic impedances of the materials mentioned by Horner, et al. since Horner, et al. do not provide values for the individual components. The acoustic impedance of the filler materials is not within 10% of the base material.

(c) Rejection of Dependent Claim 11

Dependent claim 11 recites the transducer of Claim 10 wherein the pockets of the second material are operable to generate friction against the first material in response to applied acoustic energy. The Examiner relied on the teachings of Horner et al., not Trzaskos, for the limitations of claim 11.

Horner et al. do not disclose one material operable to generate friction against another material in response to applied acoustic energy. Horner et al. provide filler in epoxy or resin (col. 1, lines 48-52; and col. 3, lines 3-14) as an alternative to solids that must be bonded to the array with adhesive (col. 1, lines 34-38 and col. 2, line 66-col. 3, line 1). As discussed above, the suggestion of no adhesive is because the epoxy or resin is self-adhering by casting. Accordingly, there is no suggestion of friction between the materials. The materials are compatible.

Degassing merely removes air, so does not free one material relative to another to allow friction.

Accordingly, reversal of this ground of rejection is respectfully requested.

Reply: Silicone Rubber and Epoxy Bond

Since silicone rubber and epoxy are compatible with the fillers of Horner, et al., they bond to the filler. For example from a common bath room, silicone rubber caulk bonds to a metal faucet, ceramic or glass. The bond prevents friction.

2. Argument with Respect to Ground of Rejection No. 2

Claim 5 is allowable for the same reasons as claim 1. Saito, et al. is not cited for and also do not disclose a composite with a first material including a plurality of pockets filled with but not bonded to particles of a second material.

3. Argument with Respect to Ground of Rejection No. 3

Claim 12 is allowable for the same reasons as claim 1. McElroy, et al. is not cited for and also do not disclose a composite with a first material including a plurality of pockets filled with but not bonded to particles of a second material.

4. Argument with Respect to Ground of Rejection No. 4

Reversal of the Examiner's rejection of claims 13-14 and 16-17 pursuant to 35 U.S.C. § 102(b) as being anticipated by Horner et al. is respectfully requested for the reasons set forth below.

(a) *Rejection of Independent Claim 13*

Independent claim 13 recites one material operable to generate friction with the other material in response to applied acoustic energy. The argument above for claim 11 is repeated below for claim 13.

Horner et al. do not disclose one material operable to generate friction against another material in response to applied acoustic energy. Horner et al. provide filler in epoxy or resin (col. 1, lines 48-52; and col. 3, lines 3-14) as an alternative to solids that must be bonded to the array with adhesive (col. 1, lines 34-38 and col. 2, line 66-col. 3, line 1). As discussed above, the suggestion of no adhesive is because the epoxy or resin is self-adhering by casting. Accordingly, there is no suggestion of friction between the materials of the backing. The materials are compatible.

Degassing merely removes air, so does not free one material relative to another to allow friction.

Accordingly, reversal of this ground of rejection is respectfully requested.

(b) *Rejection of Claim 16*

Dependent claim 16 recites the transducer of Claim 13 wherein the first material has a substantially different hardness but substantially the same acoustic impedance as the second material. As discussed above for claim 7, Horner et al. do not disclose the relative impedance. Heavy oxides, metal powders, and glass microballoons are used

as fillers in resin of silicone rubber or epoxy gel (col. 1, lines 48-52 and col. 3, lines 3-18). These materials have different acoustic impedances known to be more than 10% different.

Accordingly, reversal of this ground of rejection is respectfully requested.

Conclusion

In conclusion, Appellants respectfully submit that the rejections raised by the Examiner have been overcome for at least the reasons set forth above. Accordingly, reversal of all grounds of rejection is respectfully requested.

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Claims Appendix

1. An ultrasound transducer for ultrasound transmission and/or reception, the ultrasound transducer comprising:
 - at least one transducer element; and
 - a backing block adjacent the at least one transducer element, the backing block comprising a composite of first and second materials, the first material including a plurality of pockets filled with but not bonded to particles comprised of the second material;
 - wherein the pockets are less than 20 µm along a maximum dimension.
2. The transducer of Claim 1 wherein the first material comprises epoxy and the second material comprises silicone microspheres.
3. (cancelled)
4. The transducer of Claim 1 wherein the pockets are less than 13 µm along a maximum dimension.
5. The transducer of Claim 1 wherein a density of the first material is within 10 percent of a same density as the second material.
6. The transducer of Claim 1 wherein the first material comprises a first fraction of the volume of the backing block and the second material comprises a second volume fraction of the backing block, the first volume fraction being within 10 percent of a second volume fraction.
7. The transducer of Claim 1 wherein the first material has a first acoustic impedance to ultrasound and the second material has a second acoustic impedance to ultrasound, the first acoustic impedance being within 10 percent of the second acoustic impedance.

8. The transducer of Claim 1 wherein each of the plurality of pockets comprises a substantially spherical volume.
9. The transducer of Claim 1 wherein the first material is incompatible with the second material.
10. The transducer of Claim 1 wherein the pockets of the second material are enclosed within the first material, the second material unbound to the first material.
11. The transducer of Claim 10 wherein the pockets of the second material are operable to generate friction against the first material in response to applied acoustic energy.
12. The transducer of Claim 1 wherein the first material interconnects throughout the backing block, the backing block having a stiffness about the same as the first material.
13. An ultrasound transducer for ultrasound transmission or reception, the ultrasound transducer comprising:
 - at least one transducer element;
 - a backing block adjacent the at least one transducer element, the backing block comprising a composite of first and second materials, the second material incompatible with the first material wherein the second material is operable to generate friction with the first material in response to applied acoustic energy.
14. The transducer of Claim 13 wherein the backing block includes pockets of the second material within the first material.
15. The transducer of Claim 13 wherein the first and second materials comprise different polymers.

16. The transducer of Claim 13 wherein the first material has a substantially different hardness but substantially the same acoustic impedance as the second material.

17. (cancelled)

18. An ultrasound transducer for ultrasound transmission or reception, the ultrasound transducer comprising:

at least one transducer element;

a backing block adjacent the at least one transducer element, the backing block comprising a composite of solid silicone and a cured, nonsilicone resin.

19. The transducer of Claim 18 wherein volumes of the silicone are enclosed within the resin.

20. The transducer of Claim 18 wherein the backing block is substantially free of plasticizer.

21. The transducer of Claim 18 wherein the composite has an acoustic impedance of about 1-2 MRayl.

22-28. (cancelled)

Evidence Appendix

None

Related Proceedings Appendix

None